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PCT

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

511,402  
PCT/EP2003/003666



Applicant's or agent's file reference 2002DE305	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/EP2003/003666	International filing date (day/month/year) 09 April 2003 (09.04.2003)	Priority date (day/month/year) 17 April 2002 (17.04.2002)
International Patent Classification (IPC) or national classification and IPC G03F 7/00		
Applicant CLARIANT GMBH		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 4 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 08 November 2003 (08.11.2003)	Date of completion of this report 21 September 2004 (21.09.2004)
Name and mailing address of the IPEA/EP	Authorized officer
Facsimile No.	Telephone No.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP2003/003666

## I. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☐ the international application as originally filed.

☒ the description, pages 1-16, as originally filed,  
pages \_\_\_\_\_, filed with the demand,  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☒ the claims, Nos. \_\_\_\_\_, as originally filed,  
Nos. \_\_\_\_\_, as amended under Article 19,  
Nos. \_\_\_\_\_, filed with the demand,  
Nos. 1-14, filed with the letter of 18 May 2004 (18.05.2004),  
Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☐ the drawings, sheets/fig \_\_\_\_\_, as originally filed,  
sheets/fig \_\_\_\_\_, filed with the demand,  
sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/fig \_\_\_\_\_

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/EP 03/03666

## V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

### 1. Statement

Novelty (N)	Claims	1 - 14	YES
	Claims		NO
Inventive step (IS)	Claims	1 - 14	YES
	Claims		NO
Industrial applicability (IA)	Claims	1 - 14	YES
	Claims		NO

### 2. Citations and explanations

1). Reference is made to the following document:

D1: DE 100 01 135 A

D1 concerns a coating composition which comprises a polycondensate or precursors thereof (column 7, line 24 to column 8, line 35) and nanoscalar inorganic solid particles (column 10, lines 23 to 45). D1 discloses the use of this composition as resist for the microstructuring of components; see column 15, lines 37 to 56.

Document D1 is considered the prior art closest to the subject matter of claim 1 and discloses an arrangement that does not contain a bottomcoat consisting of an aromatic polymer or copolymer.

The subject matter of claim 1 is thus novel (PCT Article 33(2)).

2). The present invention can be considered to address the problem of developing an improved method for the microstructuring of electronics components.

The solution to this problem proposed in claim 1 of the present application involves an inventive step for the following reasons (PCT Article 33(3)):

It would not be possible for a person skilled in the art to deduce the present invention from the teaching of document D1 and from his own knowledge in the field.

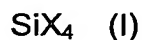
- 3). Claims 2 to 14 are dependent on claim 1 and therefore likewise meet the PCT requirements for novelty and inventive step.

## Patent claims

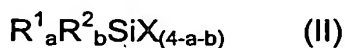
1. A microlithographic arrangement comprising

a) a microstructured layer of a nanocomposite composition comprising

- 5 a1) a polymerizable silane of the general formula (I) and/or (II) and/or condensates derived therefrom



- 10 in which the radicals X are identical or different and are hydrolyzable groups or hydroxyl groups;



- 15 in which  $\text{R}^1$  is a nonhydrolyzable radical,  $\text{R}^2$  is a radical carrying a functional group, X has the above meaning and a and b have the value 0, 1, 2 or 3, the sum (a + b) having the value 1, 2 or 3,  
and

- 20 a2) nanoscale particles selected from the group consisting of the oxides, sulfides, selenides, tellurides, halides, carbides, arsenides, antimonides, nitrides, phosphides, carbonates, carboxylates, phosphates, sulfates, silicates, titanates, zirconates, aluminates, stannates, plumbates and mixed oxides thereof, as a top coat;  
b) a bottom coat comprising an aromatics-containing polymer or copolymer containing novolaks, styrenes, (poly)hydroxystyrenes and/or (meth)acrylates;  
c) a substrate.

- 25 2. The microlithographic arrangement as claimed in claim 1, wherein the top coat a) is a sol film.

3. The microlithographic arrangement as claimed in claim 1 or 2, wherein the substrate c) is a semiconductor material.

- 30 4. The microlithographic arrangement as claimed in at least one of claims 1 to 3, wherein the nanocomposite composition contains from 1 to 50 percent by volume, preferably from 1 to 30 percent by volume, of nanoscale particles.

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5. The microlithographic arrangement as claimed in at least one of claims 1 to 4, wherein the nanoscale particles have been surface-modified with compounds selected from the group consisting of the carboxylic acids, carboxamides, carboxylic esters, amino acids,  $\beta$ -diketones, imides, quaternary ammonium salts of the general formula  $N^+R^{10}R^{20}R^{30}R^{40}Y^-$ , where the radicals  $R^{10}$  to  $R^{40}$  are identical or different and may be aliphatic, aromatic and/or cycloaliphatic groups and  $Y^-$  is an inorganic or organic anion.
6. The microlithographic arrangement as claimed in at least one of claims 1 to 5, wherein the nanocomposite composition contains polymerizable monofunctional and/or bifunctional monomers, oligomers and/or polymers selected from the group consisting of (poly)acrylic acid, (poly)methacrylic acid, (poly)acrylates, (poly)methacrylates, (poly)acrylamides, (poly)methacrylamides, (poly)carbamides, (poly)olefins, (poly)styrene, (poly)amides, (poly)imides, (poly)vinyl compounds, (poly)esters, (poly)arylates, (poly)carbonates, (poly)ethers, (poly)etherketones, (poly)sulfones, (poly)epoxides, fluorine polymers, organo(poly)siloxanes, (poly)siloxanes and hetero(poly)siloxanes.
7. The microlithographic arrangement as claimed in at least one of claims 1 to 6, where the nanocomposite composition contains a fluorosilane of the formula (III)
- $$R^3 (X^1)_3Si \quad (III)$$
- in which
- $R^3$  is a partly fluorinated or perfluorinated  $C_2$ - $C_{20}$ -alkyl and  $X^1$  is  $C_1$ - $C_3$ -alkoxy, chlorine, methyl or ethyl.
8. The microlithographic arrangement as claimed in at least one of claims 1 to 7, wherein the nanocomposite composition contains a crosslinking initiator.
9. A method for the production for microlithographic arrangement as claimed in one or more of claims 1 to 8, comprising the steps:
- i) production of a planar uncured sol film of said nanocomposite composition;

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- ii) production of a target substrate comprising a bottom coat b) and a support c);
- iii) transfer of sol film material from i) by means of a microstructured transfer imprint stamp to the bottom coat b) in ii);
- iv) curing of the transferred sol film material;
- 5 v) removal of the transfer imprint stamp to give an imprinted microstructure as top coat a).

10. The method as claimed in claim 9, wherein the uncured sol film i) is applied to a planar starting substrate comprising a support and/or an adhesion-promoting film.

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11. The method as claimed in claim 9 or 10, wherein the transfer imprint stamp comprises silicone, glass or silica glass.

12. The method as claimed in one or more of claims 9 to 11, wherein the transfer  
15 imprint stamp is pressed into the sol film i) for from 5 to 300 seconds, then removed and placed on the bottom coat b) in the course of from 10 to 300 seconds and pressed against b) for a time of from 10 to 300 seconds under a pressure of from 10 to 100 kPa.

20 13. The method as claimed in one or more of claims 9 to 12, wherein thermal curing or UV curing is carried out while the transfer imprint stamp is pressed against b).

25 14. A method for the production of a microstructured semiconductor material, comprising the steps i) to v) as claimed in claim 9, support c) being the semiconductor material to be structured, and the steps

- vi) plasma etching of the residual layer of the nanocomposite sol film, preferably with  $\text{CHF}_3/\text{O}_2$  plasma,
- v) plasma etching of the bottom coat, preferably with  $\text{O}_2$  plasma,
- 30 vi) etching of the semiconductor material or doping of the semiconductor material in the etched areas.